THE USE OF INCENTIVE CONTRACTING IN AIRCRAFT PROCUREMENT

EDWARD G. REDDEN

5x

THE USE OF INCENTIVE CONTRACTING IN AIRCRAFT PROCUREMENT

* * * * * *

Edward G. Redden

THE USE OF INCENTIVE CONTRACTING

IN AIRCRAFT PROCUREMENT

by

Edward G. Redden

Lieutenant, United States Navy

Submitted in partial fulfillment of
the requirements for the degree of

MASTER OF SCIENCE
IN
MANAGEMENT

United States Naval Postgraduate School
Monterey, California

1 9 6 5

THE USE OF INCENTIVE CONTRACTING

IN AIRCRAFT PROCUREMENT

by

Edward G. Redden

This work is accepted as fulfilling

the research paper requirements for the degree of

MASTER OF SCIENCE

IN

MANAGEMENT

from the

United States Naval Postgraduate School

ABSTRACT

The largest program in the Navy budget is procurement and one of the largest appropriations within this program is aircraft procurement. Because it does represent such a substantial portion of the budget, aircraft procurement is potentially one of the most important areas for improving cost effectiveness in the Navy. One important available instrument for increasing this cost effectiveness, by increasing efficiency in aircraft procurement, is the incentive type contract. The value of the incentive type contract lies in its ability to compensate for the lack of economic market conditions associated with aircraft procurement.

The Navy's use of incentive contracts since 1951 and the resultant opinions and actions of the Navy, government legislative agencies, and the aircraft industry are presented. These actions and opinions are discussed and recommendations for more effective employment of contractual incentives are offered.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

The procurement program is the largest single program in the Navy's annual budget and one of the largest appropriations within this program is aircraft procurement. In fiscal year 1965 Congress appropriated (all figures in millions)$2,496.4 for Navy aircraft (and missile) procurement out of a total procurement program of $5,467.9 or 45.6%. Missile procurement amounts to approximately 23% of the appropriation which reduces the available funds to approximately $1,922.3 for aircraft and related equipment alone. As an example of total military aircraft procurement, in fiscal year 1959 aircraft procurement amounted to (in millions) $6,487 or 30.5% of the total military procurement program. These huge financial transactions, so vital to the nation's defense, are carried on under very unique market conditions that require the utmost in co-operation between the government and the aircraft industry.

The Navy participates in aircraft procurement in the role of a monopsonist for together with the Air Force they comprise close to 90% of the aircraft industry's market. Associated with this monopsonist position is a great degree of price control. The Navy's objectives are to obtain the most effective aircraft to meet defense requirements within given budget restraints which implies a requirement for efficient production and avoiding the payment of excessive profits. The Navy must also participate in the general military spending objective of maintaining a sound civilian econom y and in this particular case an economically sound aircraft industry.

The aircraft industry is the nation's biggest employer[1] and several

[1] Study of Aircraft Procurement - Contract Types and Contracting Methods, (New York: Booz-Allen-Hamilton, Management Consultants, December 17, 1957), p. 10.

member firms have replaced such concerns as General Motors, Ford and Bethlehem Steel as the leading government prime contractors. Due to its dynamic nature and the extreme complexity of its product the aircraft industry acts much like a monopolist with the associated degree of price control in its dealings with the government. It is an industry of a great many risks and uncertainties due to (1) rapid technological change which often necessitates government cancellation, acceleration or modification of contracts, (2) sales instability, (3) long lead time from the design to the sale of an aircraft with the associated probability of product demand shift and input price variation, (4) keen competition for government business with non-government opportunities extremely limited and (5) diversification limitations due to the high degree of personnel and facilities specialization required.[2] The operating and production practices of the aircraft industry are influenced by these risks and uncertainties as is the outlook of commercial financial institutions which often necessitates government financial backing of aircraft development. The aircraft industry is also being greatly influenced at the present time by the growth of the missile and space business with the resultant incentive to intensify efforts in these areas at the possible expense of manned aircraft development and production efforts.

Once an aircraft contract has been secured and production commenced, the experience and investment of the contractor cannot be shifted to another contractor without undesirable costs to the government. This fact coupled with the small number of aircraft producers capable of meeting many of the government's aircraft requirements greatly contributes to the monopolistic character of the industry. The difficulties in conducting aircraft procurement

[2] J. Fred Weston, Procurement and Profit Renegotiation, San Francisco: Wadworth Publishing Company Inc., 1960, p. 123.

transactions beneficial to both the Navy and industry under this monopsonist-monopolist relationship, with the resultant lack of economic market conditions, can be greatly alleviated through the use of effective contractual incentives.

The actual contracting in an aircraft procurement transpires after an extensive amount of preliminary ground work during which time many incentives act upon the aircraft industry to provide a top quality product when it is needed but without a proportionate cost controlling incentive. Procurement procedures for an aircraft begin when the military requirements for that aircraft is determined by the Chief of Naval Operations. The necessary funds for the aircraft are provided and controlled by Congress, the Bureau of the Budget and the Department of Defense and Navy Comptrollers. This budgeting step acts as an incentive to the aircraft industry since they know the amount of funds appropriated for the project and that if the most effective aircraft isn't provided to meet requirements within the given financial restraints the available funds can be cancelled or shifted to an alternative weapon system. This incentive is substantially reduced under government high priority procurements. After funds have been approved the aircraft design competition is initiated amongst the various firms through the issuance of a request for proposals by the BuWeps Contracting Division with the obvious incentive of gaining contract award. Awards can be made for developing competing types of aircraft with performance competition determining the aircraft to be retained for service use as happened to be the case with the F-105 and the F-4H, although unintentionally.[3] Awards can also be made to more than one company for procurement of partial quantities as was the case

[3] "Battle Over Fighter Planes," Business Week, (December 30, 1961), p. 86-87.

with the B-47 (Boeing, Douglas and Lockheed) and F-84 (Republic and General Motors) during the Korean conflict. These award methods can be effective incentives for industry to provide the government with timely receipt of a highly effective aircraft but the costs for such peacetime developments and production would be prohibitive.

After design evaluation, contractor selection is made by cognizant Department of Defense, Secretary of the Navy and Bureau of Naval Weapons Personnel. Use of a contractor performance evaluation system and investigation of contractors' past profit rates by selection personnel acts as the incentive at this step of the procurement process. Following design evaluation and contractor selection a definitive procurement request [37] is issued by the aircraft sponsoring activity in the Bureau of Naval Weapons to the BuWeps contracting division. Upon receipt of the procurement request the contracting division begins negotiations with the selected aircraft firm to establish contract type, provisions and price. Although formal advertising is the recommended method for all government procurement, the finances and technical specialization required to produce the complex aircraft of today make negotiation the only feasible method of procurement. The Armed Services Procurement Regulation (3214.2) lists exceptions to formal advertising which allow the use of the negotiation method in aircraft procurement.

The incentives mentioned as acting thus far in the procurement process are but a sampling of those that continually spur the firms in the aircraft industry to provide the highest quality product on time. Due to the constant and demanding nature of these incentives the use of contractual incentives at the contracting stage of the procurement provides perhaps the greatest opportunity for improving cost effectiveness in aircraft procurement. It is

at this contract and price setting stage that the aircraft supplier begins to assume his monopolistic character but it is also at this stage that Navy contracting personnel can establish mutually satisfactory cost and profit figures, while further extending the quality and time incentives in effect up to this stage, through the effective use of the incentive type contract.

The incentive type contracts, which were developed by the Navy during World War II and which are presently authorized for use by A S P R 3-404 and 3-405, are the fixed price incentive contract (FPI) and the cost plus incentive fee contract (CPIF). The purpose of the incentive type contract is to aid in assuring that (1) the government receives the most effective aircraft to meet its requirements, (2) contract schedules are met or beneficially surpassed, (3) costs are kept to a minimum while providing an equitable profit for the contractor under the prevailing circumstances, or (4) a product completed under a weighted combination of the three previous factors. The incentive type contract should be established to induce the contractor to assume as much of the risk associated with meeting the incentive goals as is possible.

Practically all incentives are established on a negotiated sharing basis. For cost incentives, a cost sharing formula would be negotiated at 70/30 (for example) whereby the government would be responsible for 70 cents of every dollar of actual cost in excess of the negotiated target cost within the operative cost range while the contractor would be responsible for the remaining 30 cents. Conversely, for cost underruns the contractor would receive a 30 cent increase in profit for every dollar saved under target cost within the operative cost range while the government would realize a 70 cent saving on each dollar of underrun. For performance incentives, targets would be negotiated in such areas as speed, operating altitudes and

maneuverability. Predetermined rates of profit increases would be made for percentage increases in performance goals while failure to attain goals would result in profit reduction on a percentage basis. Delivery incentives are established much in the same manner as performance incentive arrangements with the substitution of target delivery or completion dates for performance targets. Whenever performance or schedule incentives are used it is imperative that a cost controlling incentive also be applied, for obvious reasons.

When the fixed price incentive contract is to be used the Navy and the contractor negotiate (1) a target cost with which to compare the final <u>negotiated</u> cost for profit determination, (2) an equitable target profit related to the target cost, (3) a maximum price for which the government will be responsible and (4) a sharing formula, before contract award is made. Under the FPI contract the contractor has no profit ceiling but with a ceiling price in effect he must provide the government with a product meeting specifications regardless of the cost to him. The cost sharing formula in effect becomes 0/100 when the ceiling price is reached. Because of this feature, the FPI contract is preferred to the CPIF contract. (See appendix A for a sample FPI multiple incentive contract arrangement).

When the cost plus incentive fee contract is to be used the Navy and the contractor negotiate (1) a target cost with which to compare the final <u>audited allowable</u> costs [25] for profit determination (2) a target fee, (3) a sharing formula and (4) maximum and minimum fees. A continued share line may be used for cost overruns vice a minimum fee which would create a cost sharing arrangement beyond any considered minimum fee point. Because the CPIF contract is used under conditions of greater development and/or

production risks than the FPI contract the minimum fee is included to protect the contractor against excessive unforseeable risks while the maximum fee protects the government from paying excessive, windfall profits. However, the incentive contract should be aimed more at increasing cost effectiveness rather than protecting against contingencies. The degree of confidence in setting incentive targets determines the choice between FPI and CPIF contracts. (See Appendix B for a sample CPIF multiple incentive contract arrangement).

The incentive type contracts have their greatest applicability in the field of aircraft procurement due to the risks associated with the industry and the complexity of the product required by the government. The wide range of performance capabilities required for most Navy aircraft, with given budget restraints, makes the use of incentive contracts most attractive. If used effectively they can provide the necessary tradeoff between risk protection and objective realization resulting in more co-operative and rewarding Navy-industry relations.

The cost plus incentive fee contract finds applicability in the stages of aircraft development and initial production. Generally during these stages the lack of cost and production experience does not allow for determination of incentive targets accurately enough to permit use of a fixed price type contract. The cost plus fixed fee is the alternative type for the CPIF. In the CPFF contract the desire for follow on production acts as an incentive for quality and timely work but there is no incentive to keep costs to a minimum as there is in the CPIF. The CPFF provides the opportunity for contractors to submit know low cost estimates to gain contract award with assurance of a particular fee and the opportunity for increasing profits on later production. With the use of CPIF the cost estimates are likely to

be more realistic since the contractor shares in any cost overruns and his fee is reduced proportionately. The CPIF provides for rewards commensurate with quality of work performed while the CPFF awards a predetermined fee regardless of the quality of performance. Except in the early stages of aircraft research when the work is of a broad general nature, the CPIF contract should be used in lieu of the CPFF for the advantage of both the Navy and the contractor.

The fixed price incentive contract is most applicable for follow on and long run production where enough cost and production experience is available to permit reasonably accurate cost and incentive targets. The alternative for this type contract is the firm fixed price contract. The FFP contract obviously acts as a greater cost incentive than the FPI contract but since profit equals fixed price minus costs there are distinct advantages to controlling costs at the expense of quality and schedule. Since the contractor's profits are reduced in direct proportion to cost increases his willingness to assume risks to improve product quality is greatly reduced. Under this type contract the Navy does not share in production experience as it would in the FPI. The Navy's often used authority to order changes to aircraft in production also makes the FFP contract unfeasible since the costs of the Navy's belated decisions can be borne extensively by the contractor. If incentives aren't provided to encourage and enhance necessary changes, technological advancements can make an aircraft obsolete before it becomes operational. Since target costs are usually determinable to about the same degree of accuracy in the FPI and FFP contracts, when cost underruns exist the contract price will be less under the FPI type since the underrun is shared by the government. Thus windfall profits can be greater under the FFP type. Except for the long run production of aircraft such as trainers

or utility types, where design and performance specifications and production processes can be assured of no further changes, the FPI contract should be used in lieu of the FFP type.

It may be argued that the incentive type contracts result in increased administrative costs but any administrative costs must be considered insignificant in comparison to the cost savings and quality advantages that can be gained through the use of the incentive type contract. The flexibility of the incentive type contracts to adapt to the many contingencies arising throughout the aircraft procurement process can make them the most useful and advantageous contract types for both the Navy and the contractor, if used properly.

Despite the many advantages offered to both the Navy and industry in the incentive type contracts they have failed to gain full acceptance due to the many difficult problems that must be overcome to insure their successful incorporation and administration. Use of the incentive contracts require more extensive planning by both parties and requires the utmost in teamwork between government procurement and technical personnel. Highly qualified government negotiators are a necessity and the problems to be overcome for effective use of the incentive contracts often requires overworking of these qualified personnel to the extent that their effectiveness is limited.

Another major problem to be met is the determination of contract costs. A great deal of the success that may result in a procurement hinges on this factor. The contractor must determine costs as accurately as possible using all available information and cost reductions that become known to the contractor prior to the completion of negotiations must be passed on to the government. All pertinent subcontracting costs must also be accurately

determined and included. It is the responsibility of the Navy contracting personnel to accurately evaluate these cost figures, for it is on the basis of these figures that target profits and profit ranges are negotiated. Not only must contract costs be determined but any cost savings that may befall the contractor as a result of the increased government business must also be weighted. Costs are probably the most important of the incentives and they are the most difficult to determine and evaluate since they are continually subject to the influence of changing factor prices and changing technology. Factors to be considered when establishing target costs are listed in ASPR 3-808.

Contracting personnel must provide the contractor with the firmest possible specifications in order to minimize the number of unknown contingencies facing the contractor. The difficulties in meeting this necessity are apparent from the broad military requirements established and the complexity of the aircraft so often needed to meet these requirements. Aircraft design must be frozen as soon as possible, for design or specification changes will often require changes to the established incentive formulas. Changes can act as a negative incentive and even necessitate acceptance of a less desirable type of contract. This was examplified when the Navy contracted for the F9F-8T. Although over 600 F9F-8's had been produced prior to the F9F-8T, the number of required changes made the use of a cost type contract necessary.[4]

Establishment of performance incentives is also a problem to be considered. The range of incentive effectiveness must cover the performance characteristics only to the extent that they are useful to the Navy's needs and thus eliminate unnecessary goldplating.

[4]Booz-Allen-Hamilton, Op. Cit., p. 120.

The Setting of schedule incentives also poses a formidable problem, for the Navy contracting personnel must have a knowledge of the contractors production capabilities and must be able to predict the optimum time for fleet introduction of the aircraft in order to make the incentive effective. Like the cost incentive, the effectiveness of a schedule incentive is dependent on the establishment of firm aircraft specifications and the minimization of design changes.

In the establishment of any and all of the incentive targets there is the difficulty of properly weighting the incentives so that any one or combination cannot be exploited at the expense of another. Careful balancing of the various criteria must be made so that any necessary tradeoffs amongst incentives will provide the Navy with the most effective aircraft for the available dollar. The setting and balancing of incentives must be made as soon as possible in the procurement process for the later that targets are established the greater is the probability that they will be too firm to act as incentives.

Probably the biggest problem to be faced, on which the successful solution of most other problems is hinged, is an intangible one. It is the problem of establishing confident, cooperative relations between the Navy contractors and the aircraft industry. The incentive type contracts cannot be used to their greatest advantage unless such a relationship exists.

CHAPTER II

BACKGROUND AND APPLICATION

Navy aircraft procurement has been characterized by extensive initial use of the letter type contract (necessitated by inaccurate cost data, long lead time requirements forcing rapid initiation of the procurement and/or a lack of firm aircraft specifications) with later conversion to the fixed price incentive contract. Approximately 90% of all Navy aircraft procurements since 1951 have been initiated through the letter type contract. Between 1951 and 1957 out of 142 Navy aircraft production contracts 84 were converted from letter type to fixed price incentive, 3 were initiated through fixed price incentive contracts, 16 were fixed price initiated or fixed price converted from letter type, 15 were cost type and the remaining 24 were still unconverted from the letter type.[5] Exhibit I lists several major Navy aircraft procurements since 1951 that utilized the fixed price incentive contract and the cost results of those contracts.[6] Several significant factors are pointed out in this exhibit. Out of the 22 contracts cited, 19 resulted in cost underruns but whether these underruns were primarily due to inaccurate target costing or contractor efficiency is indeterminable. The lowest final profit rates are associated with the cost overrun contracts and there is generally an extensive time lag between the letter contract date and the date of conversion to a definitive type contract.

Frederick T. Moore of the RAND Corporation has compiled data on cost behavior in incentive type contracts from a sampling of the 148 Navy and Air

[5] Booz-Allen-Hamilton, Op. Cit., p 98A.

[6] Abstracted from a Summary Analysis Compiled by the Office of Naval Material.

SAMPLE NAVY AIRCRAFT PRODUCTION CONTRACTS - FIXED PRICE INCENTIVE

Contractor	Contract Number	Plane Model	Firm Target Cost	Final Actual Cost	Per Cent Overrun (+) or Underrun (-)	Incentive Share Rate	Target Profit Rate	Final Profit Rate
Beech	52-900	SNB-5	$2,633,020	$3,120,100	+18.5%	20%	9%	4.5%
	52-1085	SNB-5	1,634,410	1,562, 600	-7.2%	20%	9	11.26
	52-087	SNB-5	7,056,000	5,916,960	-16.1	20	9	14.6
Chance Vought	51-863	F4U-7	13,650,000	12,866,653	-5.74	25	9	10.96
Douglas	51-020	AD-4	55,093,499	55,661,406	+1.03	15	9	8.76
	51-021	F3D-2	39,319,315	38,806,916	-13	15	8.5	8.897
	51-654	R6D-1	46,385,253	39,474,000	-3.4	20	8.5	11.19
	51-141	R6D-1	31,195,010	30,305,000	-2.85	15	8.5	8.7
	51-630	AD-4B	56,110,743	52,332,824	-6.7	25	9	11.5
Grumman	51-230	S2F-1	21,104,009	21,686,900	+2.76	15	7.5	6.9
	51-635	S2F-1,2	143,012,872	122,088,494	-14.6	20	8.5	13.53
	53-394	UF-1	12,986,000	11,769,100	-9.4	30	9.5	13.58
Lockheed	51-652	P2V-5	67,794,308	67,382,381	-0.61	25	9	9.3
	51-653	P2V-6	12,438,356	11,722,755	-6.13	20	8.5	10.4
	52-763	WV-2	56,356,261	53,408,690	-5.2	20	9	10.5
	53-604	WV-3	12,253,796	10,983,500	-10.73	15	9	11.7
Martin	51-024	P5M-1	49,026,800	45,176,398	-7.85	15	9	10.7
McDonnell	51-023	F2H-2P	114,331,889	108,575,000	-5.0	20	8	9.5
North American	51-642	FJ-2	103,509,000	92,896,850	-10.25	15	7.5	10.1
Vertol (Piasecki)	51-053	HUP-2	32,163,827	31,645,121	-1.61	15	9	9.4
Sikorsky	51-650	HRS-2,3	11,775,698	11,043,022	-6.2	25	9	11.3
	53-606	HO4S-3	10,273,475	9,397,544	-8.5	30	9.5	13.2

EXHIBIT I

SAMPLE NAVY AIRCRAFT PRODUCTION CONTRACTS- FIXED PRICE INCENTIVE (CON'T)

Contractor	Contract Number	Plane Model	Letter Contract Date	Definitive Contract Date	Interim Redetermination Date	Final Redetermination Date
Beech	52-900	SNB-5	5/12/52	6/11/53	------	12/02/53
	52-1085	SNB-5	6/30/52	6/18/53	---------	2/24/54
	53-087	SNB-5	9/02/52	6/19/53	10/02/53	9/12/55
Chance Vought	51-863	F4U-7	5/11/51	6/16/52	2/17/53	12/13/54
Douglas	51-020	AD-4	7/14/50	10/19/51	10/17/52	--------
	51-[illegible]21	F3D-2	7/14/50	1/24/52	8/25/54	1/11/57
	51-654	R6D-1	2/10/51	3/13/53	11/16/53	1/16/56
	51-141	R6D-1	8/18/50	11/20/52	9/52	10/13/54
	51-630	AD-4B	2/10/51	4/17/53	8/24/53	8/5/57
Grumman	51-230	S2F-1	10/06/50	3/02/5[illegible]	8/26/53	12/20/56
	51-635	S2F-1,2	2/10/51	3/02/53	1/06/55	---------
	53-394	UF-1	12/15/52	5/13/54	12/53	2/19/57
Lockheed	51-652	P2V-5	2/10/51	1/26/53	2/23/55	-------
	51-653	P2V-6	2/10/51	4/02/53	5/25/54	--------
	52-763	WV-2	1/09/52	6/16/54	2/24/56	-------
	53-604	WV-3	12/31/52	3/21/54	3/20/56	---------
Martin	51-024	P5M-1	7/14/50	7/03/51	1/15/53	1/19/55
McDonnell	51-023	F2H-2P	7/14/50	6/17/52	1/08/53	1/03/55
North American	51-642	FJ-2	2/10/51	11/14/52	4/12/54	-- -----
Vertol (Piasecki)	51-035	HUP-2	8/03/50	5/13/52	6/12/53	2/02/54
Sikorsky	51-650	HRS-2,3	2/13/51	6/18/53	8/12/53	6/26/57
	53-606	HO4S-3	12/31/52	3/12/54	12/53	-------

EXHIBIT I (CON'T)

Force procurement contracts with several different companies and also of 80 separate incentive type contracts with North American Aviation. The results of Moore's analysis compare favorably with the results illustrated in exhibit I. In the sample of 148 contracts there were cost overruns in 77% of the cases and in the sample of 80 contracts there were underruns 72% of the time with the large underruns (greater than 10%) generally occuring in the smaller size contracts. Moore also analyzed 250 cost contracts and found cost overruns in 55% of that sample.[7]

With so many apparent successes it would appear that the Navy has developed and is using the incentive contracts to their full potential but more recent aircraft procurements indicate that there are many opportunities for more frequent advantageous application of the seldom used cost plus incentive fee contract. One such case was the F8U procurement. In this procurement the Navy received an effective aircraft when it was needed despite the necessitated contract arrangements. Letter contract No- as 54-605 was entered into for 5 test aircraft providing for delivery of 2 of these aircraft within 10 months. At the time for conversion of this contract to a definitive type, 34 months after the letter contract, only 2 of the experimental aircraft had been delivered and there was so little cost experience that a cost type contract had to be used. No aircraft other than the test models had been produced or flown by October 1954 when negotiations got underway for the 1955 program so another letter contract (NO-as 55-170) had to be issued.[8] A properly applied CPIF contract could have helped alleviate this situation as it may also have done in the A3D procurement.

[7]Frederick T. Moore, Military Procurement and Contracting; An Economic Approach, (Santa Monica: RAND Corp., 1962), p. 47-49.

[8]Booz-Allen-Hamilton, Op. Cit., p. 109.

The A3D-1 (letter contract NO-as 52-981) and A3D-2 (letter contract NO-as 54-249) were converted to fixed price incentive contracts in late 1954. However, in the fall of 1956, due to the inability of the Navy and Douglas Aircraft to agree on cost data, the follow-on contract (NO-as 55-190) for the A3D -2 was merged with 2 prior contracts and converted to CPFF.[9] Large and partially avoidable costs overruns in the CPFF contract used during the procurement of the XP6M, XF8U-1 and A4D-1 provide a convincing argument for avoiding its use whenever possible.

Another example of where use of the cost type contract should have been avoided was in the procurement of the F9F-8T. As cited earlier in this paper, the number of changes required for developing the F9F-8T from the F9F-8 precluded the use of a FPI contract despite the facts that the manufacturer considered the F9F-8T to be approximately 90% in common with the F9F-8 and that the F9F-8 (contract No-as 53-1138) had underrun a target cost of $16.9 million by $1.6 million.[10]

Further evidence perhaps of the need for more effective contracting was the fact that as of April 30, 1961 the Navy had a backlog of 1,141 undelivered aircraft on order amounting to approximately $1.8 billion.[11]

An early but nevertheless recent use of the CPIF contract was in the A2F procurement. The contract for this aircraft was awarded to the Grumman Aircraft Engineering Corp., in January 1958 for $101, 701, 000. Cost, aircraft performance and equipment performance were the incentives applied and a 4 to 15% incentive range was set on the targets. The apparent success of this procurement is difficult to fully evaluate at this time due to the problems

[9] Ibid., p. 115.

[10] Ibid., p. 120-123.

[11] Katherine Johnsen, "USAF, Navy Criticized on Aircraft Buys", Aviation Week and Space Technology, (June 19, 1961), p. 30.

faced by the Navy in training and retaining the skilled personnel required to maintain this complex weapons platform.

The value of the CPIF and FPI contracts is quite evident in past Navy aircraft procurements and their effective use will be even more important under the relatively new weapon system approach to aircraft procurement where greater cost controls and government monitoring of contractors, vice close inspection, is required. The weapon system concept of procurement refers to the placing of maximum responsibility on one single management organization for the design and specifications of the weapon system and for integrating the various components into a fully operational system.

One of the most important influences on the Navy's use of incentive type contracts is the attitude of Congress and the resulting Congressional pressures. Amongst the members of Congress directly concerned with Department of Defense procurement activities the predominant opinion has been directed toward discouraging the Defense Department's use of the incentive type contract. This opinion is influenced by several factors, of which the most important is profits. Industries' profits on government contracts are closely scrutinized by Congress or Congressional agencies, for excess profits mean waste of the taxpayers' money and therefore a less than desirable reflection on Congressional performance. Their desire for close control of profits is reflected in three acts of legislation; the Vinson-Trammell Act of 1934, the Merchant Marine Act of 1936 and the Renegotiation Act, last extended in 1962, under which aircraft producers must refund all profits over 12% of the price of their contracts during a taxable year. Apparent unfamiliarity with the profit earning arrangements of the incentive contracts, and therefore mistrust in their use, causes the profit factor contribution to the unfavorable opinion. A second factor contributing to this opinion is the lack of price

competition for incentive contracts that Congress prefers for all government contracts. A third factor is general Congressional unfamiliarity with the problems, limitations of application, and advantages to be gained through the use of incentive contracts.

Early attempts by the Department of Defense and industry to make the use of incentive contracts more attractive were made in 1959 when they recommended to Congress that the Renegotiation Act be ammended to exempt incentive earnings from incentive type contracts from the effects of the act. Congressional objection was expressed by Rep. Carl Vinson (D-Ga.) when he claimed that industry's objective was the gain of excess profits.[12] The law was extended without change to 1962.

The opinions of Congress and the shortcomings of their criticisms of the incentive type contracts were most evident during the Special Subcommittee hearings on procurement practices of the Department of Defense during April, May and June of 1960.[13] The chairman of this committee, Rep. Vinson, lead the opposition against the Navy's and Air Force's defense of the use of incentive contracts for aircraft procurement. The subcommittee's position was based to a great extent on the inability of the Department of Defense to prove compliance with 10 USC 2306(c) which states that no incentive contract may be made unless it is first determined that (a) it will likely be less costly than other type contracts, (b) that it is the only practicable way to

[12]Katherine Johnsen, "DOD Opposes Bill To Tighten Incentive Contracting Practices," Aviation Week and Space Technology, (June 6, 1960), p. 34.

[13]U. S. Cong., House of Representatives Special Subcommittee on Procurement Practices of the Department of Defense, Section 4, Public Law 86-89, Hearings before Subcommittee, 86th Cong., 2nd sess., April 25-29, May 2-5, 31, June 1, 3, 9, 1960, (Washington: Government Printing Office, 1960).

secure the item, and these determinations must be made in writing by the contracting officer.

Representatives Vinson and William H. Bates (Mass.) frequently stressed the "likely to be less costly than other type contracts" aspect, but the emphasis was almost totally off line since the determination of any aircraft procurement contract costs are matters of human judgement and evaluation. Congress has the advantage of after the fact evaluation denied the contracting officer during contract negotiations and even in the case of a fixed price contract, the true costs (considering all implications) cannot be evaluated until after operational employment of the aircraft. Since the "likely to be less costly" and "most practicable" requirements of 10 USC 1306(c) are matters of judgment and not subject to after the fact comparison with alternative choices, a criticism of incentive contracts on these grounds is not firmly based.

Rep. Vinson also critized the incentive contracts on the grounds that maximum competition wasn't utilized in procurements under incentive contracts but as mentioned before in this paper, the complexity of modern aircraft precludes the use of competitive procurement and this is supported by the allowances made for aircraft procurement in the A S P R. The complexity of modern aircraft also provides the answer to Rep. Vinson's query as to why commerical businesses don't use incentive contracts. In regard to the Navy's use of the incentive contracts Rep. Vinson commented,

> "and all you have been able to accomplish now, for 3 years (ending December 31, 1959) is out of $2, 500 million worth of contracts it has only been effective enough to save 67 million?"[14]

It may have been only effective enough to save $67 million (2. 68%-costs were reduced by $67, 647,000 of which the government retained $48, 652,000)[15]

[14] Ibid., p. 290.

[15] Ibid., p. 620.

but that is $67 million that probably wouldn't have been saved through use of an alternative type contract and doesn't take into account the value to the Navy and the defense effort of exceeding the performance and scheduling targets.

The Subcommittee's position was supported by the testimony of the Army. Assistant Secretary of the Army for Logistics, the Honorable Courtney Johnson, stated that the Army had never found a situation in which the incentive contract would be advantageous to the government.[16] The Army also stated that incentive targets were too difficult to determine to warrant their use but under questioning from Representative Bates it was shown that the Army also had incentive payments for efficiency in some of their contract types as do the incentive contracts.[17] Representative Vinson seemed much impressed by the Army's testimony but the Army's point was not very well taken in opposition to the Navy-Air Force position wince the Army is not involved in aircraft procurement. Army aircraft are procured by the Air Force.

Another criticism of the incentive contracts was offered by Representative Vinson to General Davis of the Air Force Material Command when he stated that contractors can back the services down on incentive contracts to accept their terms or the services would have to do without the desired aircraft.[18] Such a situation is highly unlikely but if it did arise it would hold for any type contract. The competitive features mentioned in Chapter I, should preclude the occurrence of such a situation and enhance the government's position in negotiating an incentive type contract.

[16] Ibid., p. 236.

[17] Ibid., p. 365.

[18] Ibid., p. 365.

There were several instances in these hearings that indicate a lack of committee familiarization with incentive contracts that should preclude their evaluation of the contracts' usefulness. Representative Bates indicated that he thought overruns and underruns referred to the number of aircraft in production rather than costs.[19] Representative Frank J. Becker of New York stated that contractors could increase profits by 20% overall on an 80/20 sharing line rather than increasing profits by 20% of cost savings.[20] Representative William G. Bray of Indiana claimed he was leery of incentive type contracts and compared them with paying a doctor an extra fee if he saves your life.[21] The relevance and quality of such an analogy are very questionable. Representative Bray, with the concurrence of Representative Vinson, stated that if you can't trust a man enough to do a job without an incentive he shouldn't be permitted to undertake the job.[22] It takes little thought to see the shallowness of such a statement offered in criticism of the incentive type contract. Regardless of how assailable the foundations of such criticisms are, they are nevertheless a discouraging influence on contracting agencies desiring to employ incentive contracts and an influence that can, and must be changed to one of encouragement through effective, efficient contracting.

Not all Congressional opinion on the incentive contracts has been critical, but due to the lack of legislative support for the incentive contracts its proponents have been able to achieve, they must be considered to be in the

[19] Ibid., P. 309.

[20] Ibid., p. 670.

[21] Ibid., p. 668.

[22] Ibid.,

minority. Congressional appreciation of the problems and advantages of incentive contracts was probably most clearly exemplified in 1959 when Sen. Leverett Saltonstall (R-Mass.) introduced a bill that proposed ammending the U. S. Code to require the use of incentive or fixed price contracts whenever possible and to exempt incentive contracts from Renegotiation Board proceedings.[23] It is believed that such legislation could result in appreciable benefits to both government and industry but it has failed to gather sufficient support for enactment.

The Government Accounting Office is another agency of the legislative branch whose influence tends to act as a dis-incentive on the use of incentive type contracts. Headed by the Comptroller General, the GAO is responsible solely to Congress. With the influence of this Congressional responsibility, industry tends to doubt its ability to retain incentive profits with GAO auditing of contracts, and the advantages of the incentive contracts are therefore greatly reduced.

Another government agency that tends to inhibit incentive contracting is the Renegotiation Board [37]. The Renegotiation Board is an independent government agency that annually reviews certain government-industry contracts in order to determine the presence of, and reclaim excess profits for the government. The Renegotiation Act of 1951, ammended in 1958, provides allowances for the determination of excess profits in incentive type contracts. Such factors as contractor efficiency, reasonableness of costs and profits, risks assumed, type of product and contribution to the defense effort are considered in assessing incentive profits but definitive standards required for the equitable evaluation of excess profits under such variables are not

[23]The Congressional Record, Volume 105, Part 1, 86th Cong., 1st Session, January 1-29, (Washington: Government Printing Office, 1959), p. 880.

available. Such arbitrariness in the retroactive removal of incentive profits can greatly impair incentives. Another impairment to incentives is the fact that in several instances the funds required by the Renegotiation Board have approximately equaled the amount of profits earned under incentive contracts.[24] By disregarding the effects of incentive contract features on profits the Renegotiation Board tends to allow profits at rigid percentages and in effect alters incentive contracts toward cost plus fixed fee types with their associated disadvantages.

The extreme variance of views of incentive contracting held by the various departments of the government concerned with aircraft procurement is probably only exceeded by the aviation industry's variance. Requests for views on incentive contracting made to several aircraft manufacturers have resulted in referral to other sources or a "they're good if they can be made to work" viewpoint. Correspondence from the Government Contract Management Association of America, Inc., indicates that there is no industry wide norm on incentive contract evaluation. G C M A has conducted numerous seminars, discussion sessions and lectures on incentive contracting for many firms within the aircraft industry. The questions and responses received from industry in these sessions have indicated feelings of from mild interest to apathy and/or disgust for incentive contracts depending upon the particular company and/or company representative. Objective evaluation is too easily biased by the success or failure of past contracts and to whose credit the success or failure must be made. Industry, however, does appreciate the value and need of incentive contracts. This is exemplified by a statement

[24] Weston, Op., Cit., p. 8.

in the annual report of the Grumman Aircraft Engineering Corp., for 1956 concerning the effect of renegotiation on incentive contracts:

> The financial loss to the company is serious, but the removal of all incentive for efficiency is far more alarming. The incentive type contract devised to encourage efficient production, provides increased earnings for keeping costs below the agreed upon target. The Renegotiation Board has in 1953 demanded as excessive profit not only all such incentive payments but also a part of the initial target profit thereby defeating the purpose of the incentive contract.

A major goal of both government and industry must be to reduce these variant views to one of appreciation and trust in the use of incentive contracts if they are to be used to their full potential.

CHAPTER III

DISCUSSION AND CONCLUSIONS

New incentive contracting procedures and provisions, and improvements or further development of many current procedures and provisions must be instituted by both the Navy and industry if incentive contracting is to lead to the high degree of effectiveness in aircraft procurement that it is capble of attaining. Recognition and appreciation of the contractual goals and present problem areas of the Navy and industry by each other are essential if such developments are to be incorporated. However, since it is the government's dollar being spent on government defense the burden of responsibility for these developments must rest with the government. The following paragraphs contain a discussion of the various procedures and provisions of the incentive contract that provides the background for the recommendations in part IV.

The aircraft contractor's willingness to accept an incentive type contract or particular incentive arrangements within an incentive contract depends to a great extent on his business volume and financial status at the time of contract negotiations. Such acceptance conditions obviously do not consider the position of the government in a contract and for full advantage to be gained from contractual incentives these conditions must be altered. The advantages to be gained from an incentive type contract go beyond those mentioned previously of procuring the most effective aircraft possible with given budget restraints. The contractor's conditions of acceptance can be changed by awarding contracts only to firms that are willing to share an equitable portion of the contract risks through incentive formulas. The same

formulas must also be used to discourage over-optimistic producers by providing for appreciable profit reductions where standards aren't met. Such employment of incentives would tend to stabilize the aircraft industry base by forcing out marginal companies. For those companies remaining in the industry, incentives would prevent satisfaction with the status quo since increased profits would depend on increased contractor performance.

A step toward realizing these advantages is in the establishment of realistic incentive limits. The minimum acceptable standards in the contracts must provide for meeting the government's requirements while the standards for maximum incentive profits must be attainable by the contractor and useable by the government. Incentives must be used consistently so that contractors can estimate profits commensurate with effort but incentive plans must not be so standardized that they take on a fixed fee character. Targets and share ratios can be varied or combined to benefit both industry and government where standard plans don't fit particular situations. Incentive targets must be carefully evaluated. If targets are too tight a disproportionate amount of risk may fall on the contractor while if targets are too loose they may act as a disincentive since most firms are not interested in trying to gain excess profits or any particular procurement since it might jeopardize their long range profit earnings. Finally, the applicability of an incentive contract to a particular aircraft procurement, the incentive targets, and the share formulas must be mutually decided upon. A consequence of failure to mutually decide these factors was evidenced in the Air Force's BOMARC missle program where the Air Force's failure to heed the advice of Boeing on the use of an incentive type contract cost the Air Force $14 million extra in final price.[25]

[25]Katherine Johnsen, "McClellen Airs Incentive Contract Issue," Aviation Week and Space Technology, (May 28, 1962), p. 38.

Present aircraft procurement procedures and policies necessitate a great deal of reliance on initial use of the letter type contract but the time for conversion to a definitive type contract must be reduced for the effective utilization of incentives. The interim between letter and definitive contract dates leaves the government solely responsible for all costs incurred on the procurement and the later a definitive contract is negotiated the harder it is to establish effective incentives.

Once an incentive contract has been adopted there are several procedures to evaluate contract performance in addition to the most common method of comparing final negotiated or audited costs to original targets, and final aircraft performance capabilities and delivery dates to the original targets. One such alternative would be to evaluate contract performance periodically throughout the development and production of the aircraft. Such a method would lead to increased administrative expense but the periodic determination of the project's profit status should act as an added incentive to the middle management of the contracting firm. The farther down an organization the incentives can be applied the more effective they are likely to be. To further aid in moving the incentive motivation to the lowest possible levels in an organization, more liberal share formulas could be negotiated with firms operating an employee profit sharing plan. Another available procedure is to make awards for performance in an after the fact manner. This is presently being experimented with in the Cost Plus Award Fee type contract in level of service situations where the award size is determined by an evaluation board. This type of contract arrangement would reduce the profit sharing negotiations and the administrative costs of present incentive contract procedures but it would require a high degree of award consistency to be effective. This procedure is not considered feasible for general

employment in aircraft procurement, however, due to the arbitrainess of award and the absence of known incentives during the procurement process.

Design and performance specification changes ordered by the Navy are a major detriment to the effective use of contractual incentives. Often these changes must be made to keep abreast of changing technology but all too frequently they are the result of inadequate planning. Many of these changes necessitate reevaluation of incentive targets and/or sharing formulas at the cost and inconvenience of both the contractor and the Navy. Since the reevaluation of the targets and formulas are made on a sole source basis the threat of increased costs is most acute for the Navy. More extensive pre-production planning is the optimal way to reduce these changes but they could also be minimized by making their incorporation more advantageous to the contractor. Contractors' sharing formulas and target profits could be increased in proportion to the extent of contractor effort needed to incorporate the change, automatically, without initiation of claims by the contractor [25]. The increased costs to the Navy through the altered incentive award possibilities compounded with the time costs and difficulties associated with making these alterations will often outweigh the advantages of the change. Such changes would be best delayed and incorporated by the Navy. Contractor recommended changes should be approved by the Navy where the Navy's cost effectiveness will be increased but the Navy must not become so involved with such changes that any unforseen profit reductions can be attributed to their actions.

Another major stumbling block to effective incentive contracting is the present award policy. The situation was well summed up in 1962 by Thomas D. Morris, Assistant Secretary of Defense for Installations and Logistics when he stated that incentive contracts do not provide a large enough incentive for contractors to make maximum effort to reduce costs and at the same time

fail to provide adequate penalties for poor performance.[26] Too often fees are set just high enough to interest industry but well below maximum allowable [25], and then lowered on follow on contracts.[27] It may be argued that profits in the aircraft industry are above those of other industries and this claim is true if profits are figured on average return to net worth. However, if profits are figured on sales volume they fall below the profit levels of other industries. Perhaps a better criterion is to base profits on the amount of assets required to produce the equipment sold.[28] Regardless of the profit measuring method employed, profit opportunities must be flexible enough to provide the appropriate incentive for any particular contract. With the opportunity for greater profits, firms would be inclined to invest more of their finances and efforts in better products and to assume greater degrees of contractual risk. Greater profit opportunities would also remove some financial burden from the government since the aircraft firms would be able to enhance their position with commerical financial institutions. With profits restricted it can be to the advantage of the contractor to increase contract costs at the expense of limited profit losses. In this age of space exploration, restricted profits on aircraft procurements tend to make aircraft firms unwilling to accept aircraft concontracts in lieu of more lucrative space development contracts. Relaxing the rigidity of present profit spreads (for example, FPI profits tend to cluster close to 9.5%[29]) would also increase contractor performance incentive, for greater differentiation would be made for performance variations. This

[26] Bob J. Hansen, "DOD Initiates Incentive Contracts," Armed Forces Management, (June 1962), p. 43.

[27] Summer Marcus, "Studies of Defense Contracting," Harvard Business Review, (May/June, 1964), p. 26.

[28] Ibid.

[29] Booz-Allen-Hamilton, Op.Cit., P. 125.

performance incentive could be further increased by basing profit ranges on past contract performance. For greatest effectiveness this increased profit opportunity should be applied to areas of incentive profits coupled with a reduction of target profits. The Navy's method of determining target profits by use of the weighted guidelines method [25] could be continued but with reduced weights so that greater reward attainment responsibility lies with the contractor. The weighting for determination of target profits would have to be applied inversely to the degree of certainty assigned target estimates to ensure equitable profits as targets become more definitive. Reduced target profits and greater reliance on incentives would threaten the profit level of a firm for contract non-compliance or minimal effort. This would prevent the firm from assuming the defensive position of just maintaining their sales and profit levels on any particular aircraft contract. Another counter balance to the increased profit opportunity would be to reduce the incentive share formulas in proportion to the amount of contractor reliance on government material, facilities and financing. Since profits are such a small percentage of total contract price to the Navy, the availability of greater profits should result in lower overall contract price and "costs."

Renegotiation Board proceedings have also limited the effects of incentive contracts. Threat of loss of earned profits to the Renegotiation Board acts as a disincentive. Since the Renegotiation Board has no definitive criteria with which to measure incentive profits, incentive effectiveness would be increased by exempting incentive profits from Renegotiation Board action except in cases where it is the substantiated opinion of Navy contracting personnel that contractor profits are the result of chance rather than contractor efficiency. Such cases would be submitted to the Renegotiation Board for resolution.

With the increasing emphasis on the weapon system method of aircraft procurement there is the possibility of increasing the efficiency of an aircraft contract by providing profit incentives for weapon system management. Under this arrangement profit incentives would be provided to prime contractors holding weapon system management responsibility. The continuing development of modern, complex aircraft has made subcontracting costs in weapon system procurement an ever more important factor in total contract price. The emphasis in subcontracting in aircraft procurement has been shifting from the comparatively simple structure components to the intricate and expensive electronic system components and test equipment. Closer consideration and supervision of subcontract awards with increased possibilities for cost savings could be realized through employment of such an incentive.

Several methods are available for increasing the effectiveness of performance incentives in incentive type contracts. The determination of awards for performance should be based on the maintainability of the aircraft as well as the meeting of performance specifications. This could be accomplished by basing awards on the evaluation of maintenance reports such as FUR's (Failure, Unsatisfactory Report) and/or evaluation reports compiled by PAR (Progressive Aircraft Rework) personnel over a predetermined time period. Such a system might require augmenting the present maintenance report system and it might not provide a timely production incentive but by forwarding copies of these reports to the aircraft companies concerned it would provide justification for awards and provide the aircraft companies with a background on trouble areas for use in later production or new contracts.

Incentives should be applied to overall contract performance, as opposed

must be closely evaluated on any one aircraft procurement from contract to contract involving quantity changes since low quantity costs won't necessarily correspond with high quantity costs. In evaluating costs and prices the Navy must also consider the eventual maintenance and operating costs of the aircraft which can be even more difficult to determine than the original cost. The cost problem is also compounded by the urgency of aircraft procurements which is indicated by the extensive use of letter contracts. Accurate cost estimating is a time consuming effort. If, alternatively, the letter contracts are necessitated by the Navy's lack of firm aircraft plans and specifications then the proposed costs are inflated by the contractors justified proposal expenses. In the face of all these difficulties in establishing realistic cost targets, cost incentives must be established over a range large enough to keep the incentives in effect over the entire contract period. For maximum effectiveness, a cost limit should be established which must be met before other incentives are effective.

Once mutually acceptable cost targets and sharing formulas have been negotiated they often are ineffective due to the contractor's disutility for cost reductions as compared with the incentive advantages on a particular contract. The contractor may use increased costs to improve his facilities, cover overhead on other projects, or improve his product in order to secure a higher long run profit level than can be gained through comparable profit gaining efforts on a particular contract. It is the responsibility of the Navy to ensure that the profit advantages significantly outweigh the contractors' advantages of increasing costs.

The reliance on and extension of historical cost data cannot be avoided but the inaccuracies of the resulting cost targets can be compensated for in several ways. A level share line or plateau can be established around the target cost with the range of the plateau depending directly on the degree

of inaccuracy associated with the target. This provides some degree of protection against cost uncertainties to both the government and industry but as the range of the plateau extends, the opportunity for the contractor to pad costs with no reduction in profits becomes greater. An alternative method for coping with uncertain cost targets would be to review similar previous contracts, determine the mean of their cost underruns and lower the target cost in question by this mean value. This target could be used or targets could be arranged in efficiency classes with the contractor given the option of using either the base target cost or the target cost established by reducing the base cost by the mean underrun value.[30] The base cost target would have more restricted profit opportunities since the altered target would be considerably tighter.

In the CPIF contract a cost share line should be established beyond the negotiated maximum overrun figure to prevent disregard of costs beyond this point. This share line should be shallower than the portion within the effective cost range due to the original cost uncertainties necessitating the CPIF contract and established in proportion to the assumed amount of uncertainty.

To insure that the contractor's utility for cost increases doesn't exceed that for profit increases, the slope of the share line should be increased as cost savings are increased in order to stimulate the contractor to greater cost saving efforts. The Navy should also require that the contractors provide the cost data for auditing or for negotiating profits based on direct costing rather than absorption costing. This would force the contractor to separate direct and variable costs and preclude the application of cost increases to cover such items as overhead on other contracts.

[30] Moore, Op. Cit., p. 82.

Regardless of the methods employed in the utilization of incentive contracts, extreme care must be taken to insure that government controls over contractor operations are kept to a minimum. This caution coupled with the provision of industry with the Navy's long-range aircraft procurement plans to aid industry's planning will help insure the proper government-industry relations required for the most effective employment of incentive contracts.

CHAPTER IV

RECOMMENDATIONS

1. Where the use of letter contracts is necessitated, reduce the time currently being taken for conversion to a definitive contract.

ASPR requires conversion of letter type contracts to a definitive type for all military procurement within 180 days. This limit does not provide for the long lead time requirements in most aircraft procurements. For more realistic aircraft procurement requirements this limit should be extended to a 9 month to 1 year limit depending upon the type aircraft being procured. Strict adherence to this restriction should result in reduced conversion time for as can be seen in Exhibit I, the majority of the aircraft contracts in the sample required in excess of one and occasionally two years for conversion. The pressure on the government and the contractor to meet the 180 day limit doesn't permit proper determination and evaluation of costs and therefore tends to place disproportionate emphasis on development and scheduling requirements with the resultant delay in contract conversion. A more realistic conversion time combined with restrictions in the profit incentive arrangements in follow on contracts for late provision of cost information by the contractor should result in an overall reduction in conversion time during which the government assumes sole cost responsibility.

2. Provide more liberal incentive share formulas for firms operating employee profit sharing plans than the formulas negotiated with firms without such plans.

This recommendation would make appreciable profits available at the lower organization levels where the greatest potential for cost reductions

and production efficiency exists. Contractual incentives would therefore be more optimally applied.

3. Hold all non-essential aircraft changes until scheduled PAR periods and perform necessary changes in block arrangements.[31]

The use of PAR periods for aircraft changes would eliminate the difficulties and expenses of refiguring incentive arrangements for changes, reduce contract costs, and eliminate an obstacle to most efficient production. By incorporating changes in a block system, retooling costs, production delays and incentive changes are kept to a minimum. These steps would not only reduce costs but the elimination of the various inconveniences would make incentives more meaningful and improve government-contractor relations.

4. Increase the incentive profit ranges and reduce target profits.[32]

The profit spread and target profit size would have to be based on the certainty of incentive estimates but the recommended changes over present procedures would place more emphasis on efficient contractor performance for appreciable profits. Contractors would not be assured of a satisfactory profit for minimum performance and greater profit differentiation would be made available for performance variances.

5. Exempt incentive profits from Renegotiation Board proceedings except where it is determined by Navy contracting personnel that such profits are the result of chance.

This recommendation would remove the disincentive effect of the Renegotiation Board while at the same time providing a degree of protection against windfall profits. With the threat of loss or reduction of earned

[31] Booz-Allen-Hamilton, Op. Cit., p. 236.

[32] Moore, loc. cit.

incentive profits removed from the contractor, contractual incentives would better provide the stimulus for which they're designed.

6. Provide incentive profit arrangements for weapons system management.

The increased subcontracting costs of modern aircraft procurement places a great deal of responsibility on the weapon system manager. If incentives are properly applied for this management, sizeable cost savings can be realized by the government. Due to the various weapon system management arrangements that can be established, the mechanics of applying incentives to these arrangements is an area recommended for further study.

7. Base the greatest weighting for performance awards on fleet evaluation reports.

An aircraft may be able to meet pre acceptance test requirements but the true test of the aircraft's performance should be the way it meets fleet operational requirements. Maintainability under operational conditions should be the major performance criterion, for regardless of the aircraft's performance characteristics, if it can't be maintained in an "up" status its value to the Navy is negligible.

8. Key PERT to profits.[33]

Profits awarded for meeting various checkpoints in a PERT system would not only provide incentive for timely development and production but would eliminate the employment of manufacturing shortcuts or ineffective techniques to meet schedule incentives.

9. Establish cost efficiency classes.[34]

[33]Hansen, Op. Cit., p. 47.

[34]Moore, Loc. cit.

Cost efficiency classes would base obtainable profits on the certainty of established cost targets and adjusted cost targets. With the degree of profit opportunity directly related to the target certainty the government would be protected against windfall profits and the profits awarded would be a truer indication of the contractor's efficiency.

10. Employ shallow share lines for cost overruns in CPIF contracts.

Since the use of CPIF contracts is necessitated by uncertain cost targets, extension of the cost share line would protect the government against a contractor's disregard of costs once the negotiated cost floor for profits had been reached.

11. Require the use of direct costing methods.[35]

The use of direct, vice-absorption costing methods would insure that the government would only pay those costs associated with any particular contract. Direct costing is quite commonly employed in industry so it should provide no burden on the contractor for use on government contracts.

12. Place greater reliance on the use of CPIF contracts in the development stages of aircraft procurement shifting to the FPI contract in the production stages.

This contractual arrangement provides the proper combinations of incentives for the various procurement stages, if properly employed, to insure that the Navy receives the most effective aircraft for the dollars spent and to insure the contractor of an equitable profit.

[35] Bruce Backe, "Low Fees May Undermine Incentive Goal," Aviation Week and Space Technology, (January 11, 1965), p. 71.

BIBLIOGRAPHY

1. Asher, Harold, Cost-Quality Relationships in the Airframe Industry, Santa Monica, Rand Corporation, 1956.

2. Backe, Bruce, "Low Fees May Undermine Incentive Goals," Aviation Week and Space Technology, (January 11, 1965) p. 69-72.

3. Biendenpender, R. E. and W. G. Ireson, "Incentive Contracts Genuine Benefits or Hoax," Armed Forces Management, 9:1, (October, 1962) p. 61.

4. Booz-Allen-Hamilton, Study of Aircraft Procurement Contract Types and and Contracting Methods, New York, 1957.

5. Evarts, Harry T., Critical Path Analysis, Rockleigh, New Jersey, Allyn and Bacon Inc., 1964.

6. Hansen, Bob J., "DOD Initiates Incentive Contracts," Armed Forces Management, 8:9 (June 1962) p. 42.

7. Hitch, Charles J., and Roland N. McKean, The Economics of Defense in the Nuclear Age, Santa Monica, RAND Corp., 1960.

8. Johnsen, Katherine, "DOD Opposes Bill to Tighten Incentive Contracting Practices," Aviation Week and Space Technology, 72:23 (June 6, 1960) p. 34.

9. Johnsen, Katherine, "Higher Incentive Awards Penalties Due," Aviation Week And Space Technology, 78:22 (June 3, 1963) p. 84.

10. Johnsen, Katherine "House Asks for Procurement Changes," Aviation Week And Space Technology, 72:20, (May 16, 1960) p.125.

11. Johnsen, Katherine, "USAF, Navy Critized on Aircraft Buys," Aviation Week and Space Technology, 74:25 (June 16, 1961), p. 29.

12. Johnsen, Katherine, "Congress Raps Industry Contract Costs," Aviation Week And Space Technology, 70:23 (May 28, 1962), p. 29.

13. Johnsen, Katherine, "McClellan Airs Incentive Contract Issue," Aviation Week And Space Technology, 76:22 (May 28, 1962), p. 36.

14. Klass, Phillip J., "BuAer Plans Expansion of Industry Roles," Aviation Week And Space Technology, 69:20 (November 17, 1958), p. 33.

15. Marcus, Sumner, "Studies of Defense Contracting" Harvard Business Review, 42, (May/June, 1964) p. 20-22.

16. Miller, John Perry, Pricing of Military Procurements, New Haven, Yale University Press, 1949.

17. Moore, Frederick T. Military Procurement and Contracting An Economic Approach, Santa Monica RAND Corp., 1962.

18. Nossiter, Bernard D., "Management's Cracked Voice," Harvard Business Review, (September/October 1959), p. 129-132.

19. Peck, Merton J., and Frederick M. Scherer, The Weapons Acquisition Process: An Economic Analysis, Boston: Harvard University, 1962.

20. Peck, Merton J. and Frederick M. Scherer, The Weapons Acquistion Process: Economic Incentives, Boston: Harvard University, 1964.

21. Trieger, Paul M., Accounting Guide For Defense Contracts, 3rd edition, New York: Clearing House Inc., 1960.

22. Weston,J. Fred, Procurement And Profit Renogotiation, San Francisco: Wadworth Publishing Company, 1960.

23. Wilson, George C., "Defense To Stress Incentive Contracts," Aviation Week And Space Technology, 75:21 (November 20, 1961), p. 26.

24. Wilson, George C., "Defense to Emphasize Incentive Competition," Aviation Week And Space Technology, 76:18, (April 30, 1962), p. 26.

25. Armed Services Procurement Regulation, Washington, D. C., U. S. Government Printing Office, 1963.

26. "Battle Over Fighter Planes," Business Week, (December 30, 1961), p. 86-87.

27. Defense Procurement Management Course For Technical Personnel, Boston: Harbridge House, Inc., 1964.

28. "Defense Profits Will Be Linked to Contractor Performance," Aviation Week And Space Technology, 79:8 (August 19, 1963), p. 98.

29. Department of Defense Incentive Contracting Guide, Office of Assistant Secretary of Defense (Installation and Logistics) 1963.

30. "Government Use of Incentive Contracts Growing," Printers Ink, 286, (March 20, 1964), p. 80.

31. "Incentive Contract May Multiply Controls," Aviation Week And Space Technology, 79:1 (July 1, 1963) p. 98.

32. "Incentives Prove Useful But No Cure-All", Aviation Week And Space Technology, 81, (July 13, 1964), p. 64.

33. "Industry Blasts Government Contracting Policies," Steel, 155, (October 19, 1964), p. 4[illegible].

34. "Know The Pitfalls of Government Contracting," Steel, 153 (December 9, 1963), p. 49.

35. "Military Blamed for Contract Waste", Aviation Week And Space Technology, 76:7 (February 12, 1962), p. 30.

36. "More Bang For A Buck", Barrons, 43 (September 2, 1963), p. 5.

37. Navy Contract Law, (2nd ed.), Washington, D. C.: U. S. Government Printing Office, NavExos p-1995, 1959.

38. "New Incentive Contract Plan Advanced", Aviation Week And Space Technology, (January 8, 1962), p. 103.

39. "New Yarkstick for Defense Contracts", Business Week, (June 22, 1963), p. 30.

40. "Pentagon Uses Profit for Performance Plan", Iron Age, 192, (August 15, 1963), p. 101.

41. "Pitfalls in Government Contracts", Credit And Financial Management 64, (January 1962) p. 14-15.

42. "Putting Profit Spur Back Into Contracts", Business Week (May 25, 1963) p. 107.

43. "Why One Incentive Fee Contract is Paying Off", Armed Forces Management, (October 1964), p. 38.

44. United States Congress, House of Representatives, Committee on Armed Services, Hearings, Aircraft Production Costs and Profits, 84th Congress, 2nd Sess., 1956.

45. Subcommittee on Procurement Practices of the Department of Defense, Hearings Pursuant, to Section 4 Public Law 86-89, 86th Cong., 2nd Sess., 1960.

46. Subcommittee for Special Investigation, Hearings, Overpricing of Government Contracts, 87th Cong., 1st Sess., 1961.

47. United States Congress, Senate: Permanent Subcommittee On Investigations, Hearings, Pyramiding of Profits and Costs in the Missile Procurement Program, 87th Cong., 2nd Sess., 1962.

APPENDIX A

Sample FPI Multiple Incentive Contract Arrangement.

For example purposes it is assumed that the degree of confidence in establishing incentive targets warrants use of the FPI contract and all sharing formulas are simple straight line relationships.[1]

target costs ----$100 million

confidence in target cost ----$\pm$ 20% ($20 Million)

target profit ---- $10 million (10%)

target delivery ---- 24 months after date of contract award

performance incentive ---- speed

target - 500kts
maximum useable-550kts
minimum acceptable -450kts

ceiling price - $120 million

The following weights are assigned to the incentive factors:

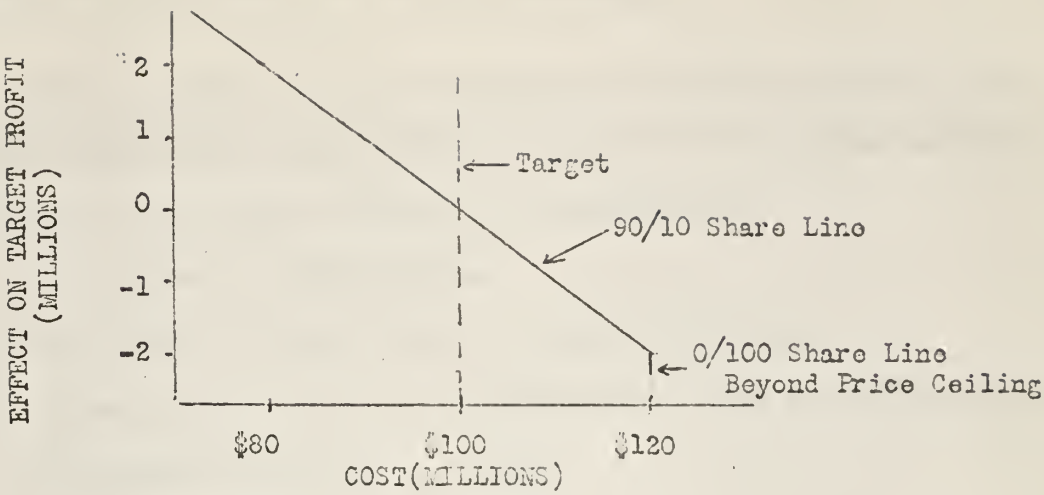
cost - 50% ($\pm$ $2 million*)

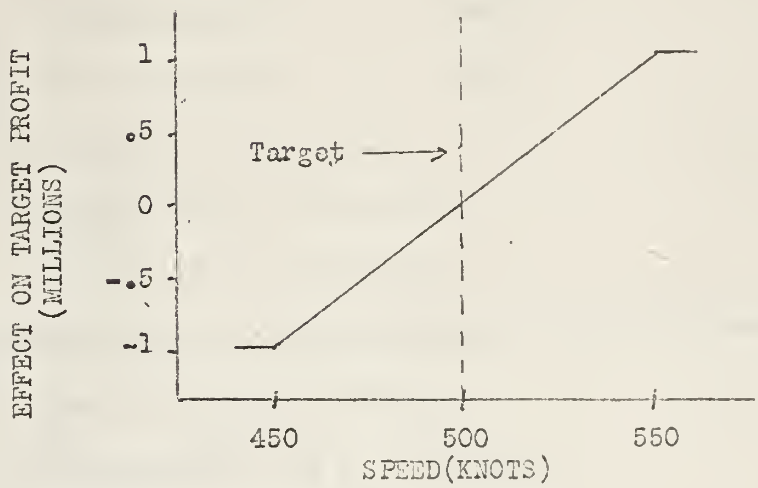
performance - 25% ($\pm$ $1 million*)

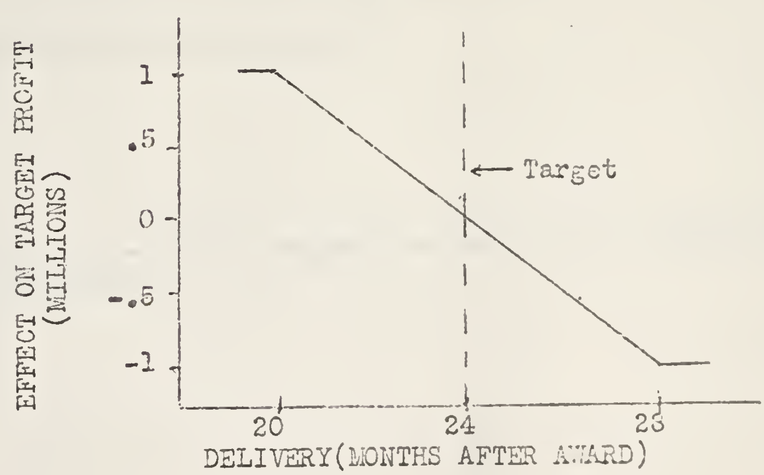
schedule - 25% ($\pm$ $1 million*)

*based on 14% profit determined reasonable for meeting maximum incentive goals and 6% profit for meeting minimum incentive goals.

[1] Refer to [29] for examples of bent line, stepped and asymetrical sharing formulas.


EFFECT ON TARGET PROFIT (MILLIONS)
2
1
0
-1
-2
Target
90/10 Share Line
0/100 Share Line Beyond Price Ceiling
$80
$100
$120
COST(MILLIONS)


EFFECT ON TARGET PROFIT (MILLIONS)
1
.5
0
-.5
-1
Target
450
500
550
SPEED(KNOTS)


EFFECT ON TARGET PROFIT (MILLIONS)
1
.5
0
-.5
-1
Target
20
24
28
DELIVERY(MONTHS AFTER AWARD)

APPENDIX B

Sample CPIF Multiple Incentive Contract Arrangement.

For example purposes it is assumed that the degree of confidence in establishing incentive targets warrants use of the CPIF contract and all sharing formulas are simple straight line relationships.[1]

target cost ----$100 million

confidence in target cost ---- $\pm$ 25% ($25 million)

target delivery date ---- 24 months after date of contract award

performance incentive ---- speed

target	-	500kts
maximum useable	-	550kts
minimum acceptable	-	450kts

target fee -- $5 million

maximum fee -- $9 million

minimum fee -- $1 million

The following weights are assigned to the incentive factors:

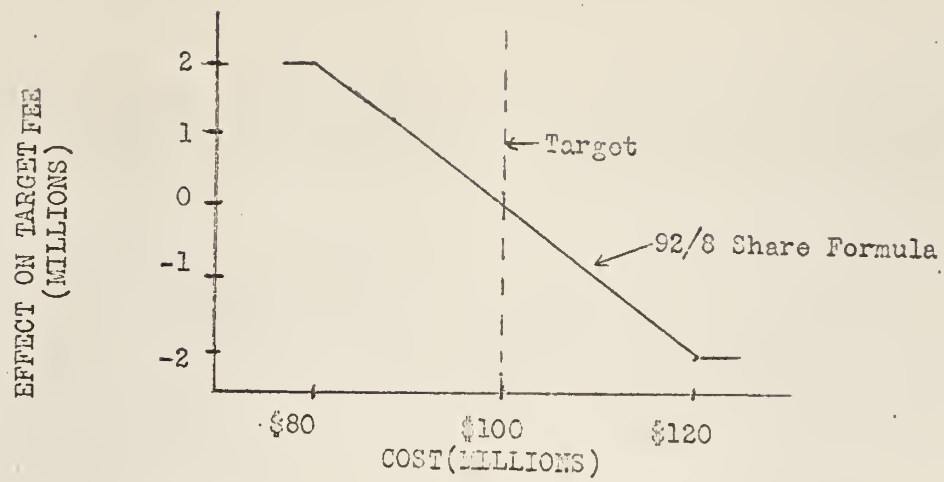
cost - 50% ($\pm$ $2 million-)

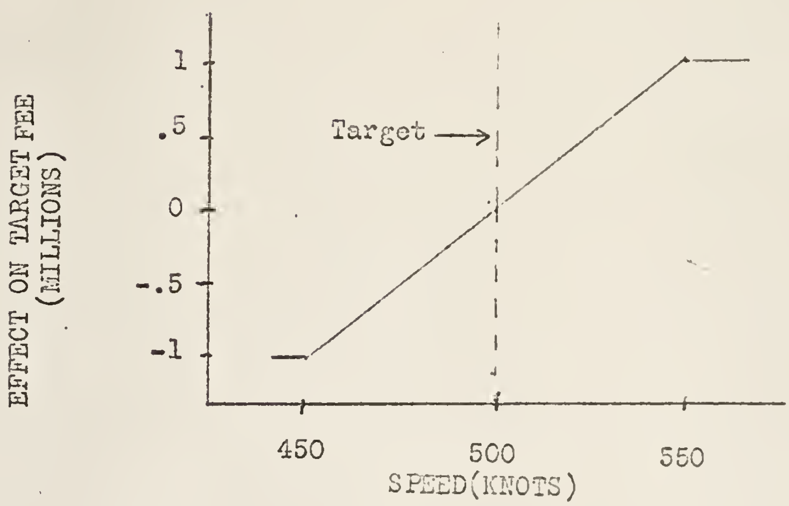
performance - 25% ($\pm$ $1 million*)

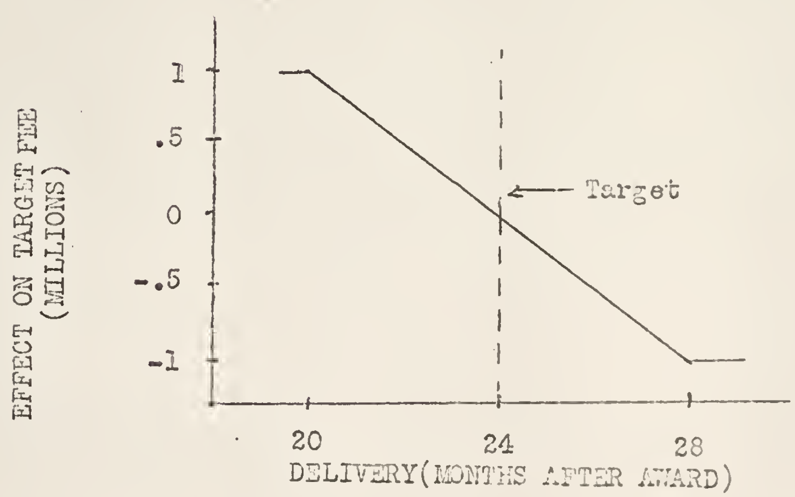
schedule -- 25% ($\pm$ $1 million*)

*Computed in terms of target fee

[1]Refer to [29] for example of bent line, stepped and asymetrical sharing formulas.


EFFECT ON TARGET FEE (MILLIONS)
2
1
0
-1
-2
Target
92/8 Share Formula
$80
$100
$120
COST(MILLIONS)


EFFECT ON TARGET FEE (MILLIONS)
1
.5
0
-.5
-1
Target
450
500
550
SPEED(KNOTS)


EFFECT ON TARGET FEE (MILLIONS)
1
.5
0
-.5
-1
Target
20
24
28
DELIVERY(MONTHS AFTER AWARD)